MODIS TEAM MEETING

Distribution:

Richard Weber	**Bruce Guenther**	Larissa Graziani
Rosemary Vail	**George Daelemans**	**Bob Martineau**
Mitch Davis	**Bob Silva**	**Lisa Shears**
Ken Anderson	**Robert Kiwak**	**Mike Roberto**
Rick Sabatino	**Harvey Safren**	**Gene Waluschka**
Cherie Congedo	Ed Knight	**Bill Barnes**
Jose Florez	Harry Mongomery	Les Thompson
Gerry Godden	Marvin Maxwell	**John Bolton**
Bill Mocarsky	Sal Cicchelli	**Helen Phillips**
Hongwoo Park		

Febuary 06, 1996 Attendees are marked in **BOLD** and **Underlined**

The Following items are included in this package:

1) SBRC Weekly Submission Memos form week 219
2) CDRL-521 - MODIS Weekly Status Rpt. week ending 2-9-96
3) MODIS Technical Weekly

MODIS Technical Weekly **February 9, 1996**
sent to MODIS.Review

1.0 Introduction
Eugene Waluschka made two trips to SBRS in late January. Eugene believes the lens breakage problem has been solved. At the time of his report (2/2), he was not yet convinced the registration problem has been solved. Gene noted a statement from the last weekly that "The Landsat crew is now unhappily garbed in bunnysuits" is not all together true. When Gene was in the clean room at the end of January (1/23/96), he noticed a SBRS type walking about in whose clean room outfit was a short smock.

Gerry Godden seeks information on the warm shield aperture stop and mentions the "proof-by-comparison" thermal cycling of another part rather than the flight part (note: the part to be temperature cycled is another flight part). Gerry also believes that epoxying the radiative cooler to the aft optics assembly is dramatic for a sub-pixel co-registration shift. Shi-Yue Qiu and Gerry have completed the Space View Port surround calculations and have started modeling scatter from the Black Body surround.

Bob Martineau provides flight detector status. He also comments on the NIR FPAs experiencing premature saturation because the optical elements have higher transmission than expected. SBRS was considering using neutral density filters as a fix. Bob asked if they had looked into adjusting the rails to accommodate the extra charge. This approach was used for the S/MWIR and SBRS will look into this method for the NIR.

George Daelemans provides a message from Avery Galbraith on the Bench Test Cooler status. Avery identifies several problems with the BTC, based on a conversation with Paul Bortfeldt. Avery, Vernon Alferd, and Chris Laufer have been working on BTC acceptance testing methodology and instrumentation. As of 2/2, Chris and Avery planned a trip to the contractor, CTS, within about a week or so.

Jose Florez provides inputs from the February 5 electronics telecon. The electronics level specs include the increased cold temperature limit of -25 degrees C to + 60 degrees C, while the Circuit Card Assembly test procedures show - 10 degrees C to + 60 degrees C. Twelve connectors were received from MALCO on 2/5 (of the 6 or seven received a week earlier, only one was accepted, because of epoxy microvoids in the others). The power supply was reworked at Hughes Torrance to correct a cold test noise problem.

Ed Knight presents a case for running the atmospheric absorption Special Test Request (STR) and that SBRS proceed with system level spectral response measurements even with potential atmospheric absorption problems. Ed also identifies component data required for the calibration algorithm. He identifies a disconnect between the test plan presented at the QMR and the PVP/PVS (note that a revision of the PVP/PVS is due shortly for GSFC review), and provides a draft of MODIS sample orbits for S/C integration and test.

Bill Mocarsky and Sahag also noted that the PVP/PVS test matrices at the end of the text have not been updated. If necessary, Bill has asked about having a splinter at the QMR, about a day of someone's time. Bill also needs an up-to-date on the LMAS plan to integrate MODIS.

Conversations with Tom Pagano:
1) February 5. Tom responded to questions which had been raised by Gerry Godden and Ed Knight. The status of the system level far field ORDAS modeling is that Eric Fest is adding doors to the model. He hopes to complete the work next week. Jim Young has put out a memo for Part 3, response versus scan angle. The solar diffuser is ready for integration and BRDF measurements have not been done on the solar diffuser. SBRS is debating doing BRDF measurements on witness samples.
2) February 8. Discussed with Tom a possible fall back position mentioned by Bill Barnes to determine whether or not STR60, the atmospheric water absorption special test, would have to be run. This needs more discussion at GSFC (see Tom Pagano entry below).
3) There was also a conversation with Tom regarding a request a change to the Performance Verification Specification for the Bright Target and Dark Target Within Field Stray Light requirements verification. SBRS may request that compliance to these requirements be verified by analysis. The rationale is that the Near Field Response Test will acquire data that can be used to verify compliance for this test (see Tom Pagano entry below).

2.0 Eugene Waluschka (SBRS Trip Report)
from Eugene Waluschka, 2/2/96, 11:30 am

On January 23 to 26, I visited the newly named Hughes Santa Barbara Remote Sensing (SBRS) group. I am currently back at SBRS and will be here through the weekend. The current mis-registration of the MODIS cold focal planes with respect to the NIR focal plane and the breakage of a SWIR lens (among others) were the main reasons for the first and this current trip. The fact that we were on furlough and additionally closed by a winter storm and hence not in official contact with SBRC(S) for about one month did not help the technical monitoring. Viewing the hardware and talking to the people who originate all of those memos is sufficiently different to just reading the memos and talking on the telephone to dispel, in my mind, any questions I may have had about the site visits. Especially as there is a major optics related problem (the mis-registration) which is still unresolved as of today Wednesday January 31, 1996. The breakage's of the lenses does not appear to be a future problem, but I am not convinced that the mis-registration will "cured". More details and reasons for these conclusions and other observations follow.

Let me start with the breaking of the SWIR lens. The reasons for this latest breakage, if I understood correctly, are that the mechanical analysis did not go down to the lens (glass) level. The breakage did prompt SBRS to model the adhesive bonding details. The results

of the computations are that the model predicts and experiment confirms that excessive stress was placed on the cadmium telluride lens resulting in a piece of lens chipping off. There were just too few glue spots resulting in a concentration of stress. Not enough surface area to distribute the load. I believe that similar reasons, not enough attention to mechanical mounting detail, apply to the other refractive lens failures. The is a expensive opto-mechanical lesson.

To appreciated what a vibration entails I took the opportunity and witnessed the penalty vibration testing of the refurbished fold mirror which it survived. Now on to the more persistent registration problem.

After more than one week at SBRC I am still somewhat confused about the causes and the magnitude of the mis-registration errors. The problem is that the two cold focal planes (SWIR and LWIR) have been measured to be about 50 microns displaced after a vibration of the aft optics platform (AOP). The AOP is the graphite epoxy structure with only the objectives on it. At this point I will refer the interested reader to David Jones' 29 January 1996 weekly report for a description of the (as we know them) events. I will put down a list of items which I think contributed to the original problem and the reason why SBRS is having such a hard time (this is the fourth week) solving this problem.

Firstly, this is flight hardware and requires special attention and lots of paper work before anything can be touched, moved or looked at. Without the paper work this is intrinsically an easy problem. It really is without the paper work.

The turn around time from the data taking to the determination of the positions of the focal planes is still somewhat long. I am told that it is now about three hours. My understanding is that it was almost eight hours a week ago. Briefly the sequence of events is that the (IAC) projects moving slits onto the focal planes. These line spread measurements each generate about 8 megabytes of data per scan and about 20 scans are needed to determine the centroids of enough pixels to determine reasonably well the positions of the focal planes. This alone took about 3 hours to transmit the files from the data acquisition computer to the computer which would process data. SBRS is looking into making the entire process faster, but my understanding is that this is not a high priority as the expectation is that this is only a temporary setup so why bother. The current speed up in part just takes (or transmits) much less data. Enough data to only determine the centroids of representative pixels on the focal planes.

There is no understanding what causes the mis-registration. There is lots of speculation. This is in part due to the fact that the exact handling history is not clear. Consequently imaginations and individual intuitions have had the opportunity of replacing hard facts. This has resulted in debates where roughly put one faction feels that the radiative cooler is in some way the cause of the problem whereas others feel that it is not. Robert's Rules of Order have been invoked as a means of controlling debate. Engineering has become a deliberative process.

There is some uncertainty as to the exact motions. The prevailing wisdom is that both of the cold focal planes move together, hence the cause is the radiative cooler. However, other interpretations of the data have been voiced which suggest that a roof mirror and a (eye?) lens assembly are possibly also contributing to the mis-registration.

The data processing itself was also called into question or was another source of confusion. This, if I understood the explanation, is due to the following factors:

> The pixels are positioned on the respective focal planes in such a manner as to compensate for the distortions caused by the telescope. Without the telescope the pixel centroids derived from the line spread information obtained by shining the IAC directly into to the aft-optics produces a distorted grid. It is possible to compensate for this as the distortion is known. However this is another processing step and one which may be a source of error. The last thing the you want when data processing are questions about each and every step.
>
> Calculating the center of a focal plane by looking at the, say, intersection point of the two diagonal lines associated with a focal plane. (A diagonal line on a focal plane is one which passes through the centroids of two opposing corner pixels, here a picture is worth a lot of words.) And comparing these calculated focal centers is a way of getting around the pixel distortion questions mentioned in the previous paragraph, but it introduces its own questions about what does registration mean. It has also introduced the terms (if I understood correctly) "image space registration" and "object space registration".

The entire alignment process should have a lot of input from the optical designers. Sensitivity tables by themselves are simply not enough. The "STOP' analysis is one example of sensitivity tables not being enough. So is this. It is possible to simulate the experimental setup fairly easily and very quickly go through all probable and not so probable combinations of mechanical motions to see if the measured mis-registrations can be reproduced on the computer. This would be a good deal less ambiguous and contentious approach to solving the problem.

I see that I am on page three and it is time for me to conclude.

3.0 Gerry Godden (comments on David Jones' report)
Author: godden@highwire.gsfc.nasa.gov (Gerry Godden) at Internet
Date: 2/5/96 8:16 AM
Subject: David Jones Weekly report
---------- Message Contents ----------

Two issues come to mind as I read David's weekly report for WE960204:

1) Regarding David's report item: 2) Replace the LW warm-shield-aperture-stop (an epoxy operation). Note: The current plan does not call for a repeat thermal cycling of the flight part, but instead SBRS propose thermally cycling a "dummy" for "proof-by-comparison".

It is not clear to me where/what the LWIR aperture stop is. I assume that this is embedded within the LWIR objective, and does not limit the fore-optics aperture stop, nor the field-stop. If you have a drawing, sketch or otherwise of this item, I would appreciate getting a copy so I can be sure we have this properly in our model. It is not clear to me that this is in the current CODE V model.

2) I am surprised to read that SBRS plans to epoxy the RC to the OBA. This sounds dramatic for a sub-pixel co-registration shift. Is it clear that this will not cause a major problem if, for some reason, they need to disassemble these units?

FYI: Shi-Yue Qiu and I have completed the SVP surround calculations and are summarizing results now in a written report. We have started to model scatter from the BB surround in the same manner so we can properly handle the difference-scatter between these two views through the ATBD thermal calibration algorithm.

4.0 Bob Martineau (Flight detector status)
email from Bob 2/8/96 at 2:08 PM

February 6, 1996

1) Flight Model 1 Detective Assemblies and FPAs:

- The NIR, VIS, and SMWIR F1 FPAs have been delivered. The F1 LWIR DA completed testing and was waiting for a filter/bezel assembly, which was received last Friday. CTI is expected Feb. 14 and delivery to Systems Division is planned for Feb. 16.

2) Flight Model 2 Detective FPAs:

- The F2 VIS and NIR FPAs have been delivered. The F2 LWIR and SMWIR DAs have completed testing and are awaiting filter/bezel assemblies. Filter/bezel assemblies are expected in 2 weeks (Feb. 19th) with CTI and delivery in another 2 weeks (1st week of March).

3) Saturation of NIR FPAs:

- Because optical elements have a higher transmission than expected, NIR FPAs are experiencing premature saturation. This would normally be handled by resizing capacitors on the readout chips, but it is too late now to redesign. I spoke to Mary about this problem, and she said SBRS was considering using neutral density filters as a fix. I

asked her whether they had looked into adjusting the rails to accommodate the extra charge. This approach was used in the SMWIR to alleviate higher than expected background photon fluxes. Mary said they had not looked at this possibility yet. Perhaps they could raise the rails one volt, but it may not be enough. She said she would look into it.

5.0 George Daelemans (Bench Test Cooler Status)
author: "Daelemans, George" <gdaelemans@mail724.gsfc.nasa.gov> at Internet
Date: 2/8/96 1:18 AM
Subject: FW: BTC UPDATE 2/6/96

From: wgalbraith
To: Daelemans, George
Subject: FW: BTC UPDATE 2/6/96
Date: Wednesday, February 07, 1996 9:43 AM
Priority: High

George:

I hope this does it!

- Avery Galbraith

From: Galbraith, Wisner A on Tue, Feb. 6, 1996 12:04 PM
Subject: BTC UPDATE 2/6/96

Vernon:

On Saturday, Paul Bortfeldt and I discussed his visit of last Friday (2/2/96)to CTS. Paul told me he was at CTS for "a couple of hours," and witnessed a cool-down and nominal steady-state operation. He said that as far as temperature stability goes, he noted some improvement (but not much) relative to the December 15 trip you and Jim McCann made to CTS. Paul said that if the December performance rated a "3" (on a scale of 10) what he saw Friday rated about a "4."

From what Paul told me, I would say that several problems have been identified:

1. There were many leaks in the exhaust gas line, making it impossible to effectively manipulate boil-off gas (vent) pressure for temperature control as desired.

2. The constants values entered into the temperature and flow controllers are not correct.

3.. CTS does not have adequate experience trouble-shooting control system problems. They also do not have any sophisticated instrumentation that can be used for this. (They are trying to teach themselves - from books - and are willing to rent adequate equipment if it can be identified for them.)

4. CTS does not SEEM to be taking a well-thought-out systematic approach to resolving this issue. As I understand Paul, he feels that they are working hard, but not necessarily effectively.

5. The Lake Shore temp sensor on the SBRC Test Dewar may be out of calibration. Paul said he consistently saw colder temperatures at the Test Dewar sensor than at the Cooling Head diodes.

6. Paul feels that an accumulator (what CTS is calling an "anti-surge" volume) that was put in the vent line between the cooling head and the control flow meter to damp out pressure spikes is slowing response time too much. CTS is aware of this concern, and is taking another look at the problem.

7. No useful vacuum gauge has been connected to the system. CTS is using some LEDs on their turbo pump that indicate that the pump is working OK, but Paul feels that a real vacuum gauge, as close to the Vacuum Shroud as possible, is important for monitoring internal o-ring seal integrity.

As you know, Vernon, Chris Laufer and I have been working on BTC acceptance testing methodology and instrumentation, especially in the area of the critical 0.03K/second maximum rate-of-change requirement. Chris has worked out what looks like a pretty good scheme for checking out this performance: he tested it out over the weekend, and it looks good. This afternoon, Bob Burns (quality) approved Chris's idea.

Per our talk with you this afternoon, Chris and I are making plans to visit CTS. What has to happen before we go is:

A. Items 1 and 5, above, have to be dealt with. I've spoken to CTS about this, and will do so again tomorrow.

B. Chris will work out getting a "crash course" in controller tuning from Joe Kleeburg. We hope this will help us be able to adequately remedy Item 2 and, to some extent, Item 3 of the above list.

C. Either by loan of SBRC equipment, or by working with CTS in selection of rental equipment (DMM, digitizing scope or recorder, etc.) we should be able to eliminate Item 3 from the "concerns" list.

D. Manufacture a good cable for connection of the Test dewar to the instrumentation. Greg Hughes says he has the suitable dewar-end connector, and Jeff Hanson says his group will get going on the cable as soon as they have the information.

E. Find a way to get an appropriate vacuum gauge in place, mounted directly off the Vacuum Shroud. I'm working on this.

F. Set up, through procurement, approval of a no-cost change to the specification, substituting an external precision current source for the existing 0-5V analog controller output. I've already talked to Norma Unzueta about this. She's given her OK, with the stipulation that the spec be changed before the BTC hardware ships.

A positive note is that the LN2 inlet metering (needle) valve seems to be working fine now. The cooldown performance curve CTS ran today has them pleased with at least this aspect of the situation. Also, new software for the TRI 3000 temperature controller has the resolution improved from .02K to. 002 K (However: Paul says when he was at CTS, the control loop for this -feedback from the vent gas flow meter - was not operative. According to CTS, this is not a hardware problem, but rather another controller constant issue they're working on.)

All in all, Vernon, it looks like Chris and I should be able to get up to CTS in a week or so (possibly sooner). I'll keep you updated on a daily basis.

- Avery

6.0 Jose Florez (Electronics Telecon)
Telecon with Ed Clement, February 5, 1996, 2:30 pm

The SAM and FAM box level test procedures are expected to be released by the end of this week. The MEM will be released in a couple of weeks. A difference from the already released CCA test procedures will be in the temperature range. The box level specs include the increased cold temperature limit of -25C to +60C, while the CCA test procedures show -10C to +60C.

Twelve connectors were received this morning from MALCO. Of the ones received last week (last week Ed said it was 7, this week he said 6, take your pick), only one was accepted by SBRC. The rest had voids in the epoxy and you could see all the way into the crimp. The one accepted will be used in the Digital Telemetry board being reworked now.

The Power Supply was reworked at Hughes Torrance due to a noise coupling problem discovered during cold testing which caused it to shut down. Modifications were minor, three resistor values were changed. It should be back in acceptance testing by now. Delivery of the PFM is expected on 2/26/96, and the FM1 on 4/3/96.

SBRC has given Sypex the option to use a thicker bottom package for the next batch of parts to be made. They did not require it because they are not convinced that is the problem. They base this on the fact that the parts that were analyzed at SBRC showed that the substrate would not separate from the package without breaking. At this point the feeling is that the reason for the problem may never be known.

7.0 Ed Knight
a) STR on atmospheric absorption
b) Component Data Required for Calibration Algorithm
c) Disconnect between PVP/PVS and test plan presented at December QMR
d) Draft of MODIS sample orbits for S/C I&T

a) STR on atmospheric absorption
Author: eknight@highwire.gsfc.nasa.gov (Ed Knight) at Internet
Date: 2/6/96 4:38 PM

Introduction

In an email on February 1, Tom Pagano raises a concern about the system level spectral measurement of the LWIR bands given susceptibility to atmospheric absorption. Specifically, Jim Young has proposed an STR to demonstrate SBRS's ability to verify that the atmospheric absorption effects can be accounted for successfully. Tom Pagano asks if GSFC can accept using the component data convolved up to system level and then cut this STR (and the relevant system level performance tests) from the plan.

Note that this STR is relevant to two issues--the system level spectral measurement and the system level radiometric calibration measurements with the SIS(100).

We have been looking at the component level measurements (Knight) and the problems of atmospheric absorption (Godden) for some time. It is our recommendation that this STR not be cut and that SBRS proceed with the system level Spectral Response measurements even with the potential atmospheric absorption problems. Our reasons are given below.

Component Level Data Quality

The component level data is not of sufficient quality to rely upon alone.

First, there has been no error analysis performed to date by SBRS or GSFC on how the uncertainties for each element will add up. Given 18 components in the LWIR chain, with typical uncertainties of ~0.1 to 1%, it is not difficult to quickly get large uncertainties in the relative spectral responses. To date SBRS has not provided the measurement uncertainty of the MWIR and LWIR filter measurements. The Science

Team will ultimately decide what uncertainty is tolerable, but we do not feel that we can even provide a reasonable estimate of the uncertainty at this time.

Second, the majority of the optical elements in the published spectral responses for the PFM are modeled or EM values rather than measured (14/19 in the MWIR and 10/19 in the SWIR). Most of these components are spectrally flat across the bandwidth, which is why we have faith in our predicted system level responses being representative of the final performance. However, EM and PFM results have shown that the predicted and actual optics transmissions were quite different, implying that our models are at least partially wrong. It is one thing to say we trust the models enough to accept a filter deviation and another to trust the models enough to report the official MODIS spectral response.

Third, much of the data we have is incomplete. The LWIR filters were not measured adequately near the edges of the extended bandpass. Specifically, for PFM, the data does not cover the upper 5% point for Band 28, the lower or upper 1% point for Band 29, the upper 1% point for Band 34, or the lower 1% point for Band 35. Therefore, SBRS has not yet demonstrated specification compliance for some of the spectral performance requirements.

Fourth, none of the component level data yet gives us an understanding of the out-of-band performance. Much of the out-of-band response is in the region immediately outside the 1% points, and would be measured at the system level under current proposals by Jim Young. This data does not exist at the component level. We would be relying completely on the integrated out-of-band measurements to demonstrate specification compliance--something the Science Team has expressed discomfort with.

We believe that we need the system level measurements to serve as the official MODIS spectral response or to verify the component level measurements.

EM System Level Results

In comparing the EM System Level Results with the predicted responses based upon component level measurements (Review of EM Test Data, Vol. 1., p. 163), large discrepancies in Bands 27 and 31 were noted and small discrepancies in 28-30 and 35. While it ascribed to atmospheric absorption, this was never proven (Jim Young's ability to model it as such aside). We know that Bands 27 and 31 are strongly affected by the coatings on the masks and the dichroics. Since the masks were not measured for EM, they may also have caused the discrepancies for Bands 27 and 31. Other possible flaws in the model could account for the discrepancies as well. Thus, we believe that the EM showed that we could verify the spectral model, but it did not in itself verify the spectral model.

We believe that the addition of atmospheric measurements is necessary to understand discrepancies between the system level measurements and the component level based model.

Comments Regarding Jim Young's Assessment

The design of STR-60 looks quite good. Jim's assessment in terms of the three possible outcomes he identifies, and his assessment of the likelihood of each of them, also look quite reasonable. For this reason, and the reasons sighted above, this STR should be completed as planned.

It is appreciated that STR-60 will also unambiguously determine the levels of uncertainty to apply to the SIS(100) radiometric calibrations. Short of this reasonable and rigorous approach, a possible alternative to STR-60 might be to "sacrifice" absolute knowledge of the MODIS band most affected by water vapor, i.e., Band 27 (i.e., we would probably have to rely on component measurements for this band). Collect data for at least three significantly different path lengths (i.e., P1: P1 + delta P12; and P1: P1 + delta P13), and use these data, together with MODTRAN, to determine the relative humidity throughout the data collection time period for the other bands. By arranging two equations (comparing P1 to P2 and P2 to P3), it should be feasible to determine P1 and the relative humidity. This should turn out to be a very sensitive way to determine the local and contemporaneous relative humidity, which can then be applied to the path corrections for the remaining bands. Admittedly, this methodology is not as rigorous towards determining correction uncertainties as that outlined in STR-60, but with the trend towards increased reliance on the Solar Reflectance Based Calibration, this will probably be acceptable.

---

b) Component Data Required for Calibration Algorithm

Author: eknight@highwire.gsfc.nasa.gov (Ed Knight) at Internet
Date: 2/9/96 2:21 PM
Subject: Component Data required for Calibration Algorithm
---------- Message Contents ----------
Subject: Data from component and sub-assembly measurements

Recently, MCST completed a comparison between the Level 1B calibration algorithm and the data sets that will be available through the TAC analysis effort. Several items that will be required for the algorithm are not collected at the system level, but come from component level or assembly level measurements. We have been unable to locate these in the technical memos or reports released by SBRS to GSFC to date, but we believe that SBRS has measured, or will soon measure each of these items. Basically, I think that they just haven't gotten it into reports yet.

Where possible, we would appreciate getting the data in electronic

form.

The sub-system level data we require is:

Solar Diffuser BRDF measurement results
OBC BB surface scatter and emissivity measurement results
SRCA didymium glass measured spectrum
SRCA spatial reticle dimensions as-built
SRCA Reference SiPD and Calibration SiPD spectral response, linearity, and temperature dependence
SRCA nominal values of the following items if different than that in
the cited reference:
half included angle beta = 15.355 degrees (N04744)
= 15 degrees (Q05525)
grating motor offset angle theta_off = 0.107
angular displacement between didymium slit and exit slit
delta = 0.02 (N04744)
focal length 260.6 mm (Cal presentation 9/28/93)
grating spacing A = 4.24 um (N04744)
= 222 lines/mm (CDR)
grating blaze angle = 9.2 degrees (CDR).

In addition to those above which are required for the algorithm, the following sub-system level measurements or modeling results would be valuable:

SDSM filter and blocking filter transmittances as a function of wavelength
SRCA ND filter transmission as a function of wavelength
SRCA order sorting filter transmittances as a function of wavelength
SRCA aperture spatial uniformity
SRCA output relative spectral response in radiometric mode
SRCA monochromator steps, per band
A/D conversion levels (volts for each bit level)

---

c) Disconnect between PVP/PVS and test plan presented at December QMR

Author: eknight@highwire.gsfc.nasa.gov (Ed Knight) at Internet
Date: 2/8/96 10:31 AM

Subject: Disconnect between Performance Verification Plan and Test Plan presented at QMR.

In reviewing the test plans, we have identified a disconnect between the Performance Verification Plan and the current SBRC integration test plan, last presented at the QMR (Table 11-1, 3rd and 4th charts in System Integration and Test section).

Specifically, it is extremely difficult to relate the two documents to each other. One significant example is that the PVP identifies two levels of comprehensive testing, CPT-1 with 11 tests, and CPT-2 with 9 tests and shorter versions of the calibration tests. In Table 11-1, these have been broken into individual Comprehensive Performance tests. Similarly, the Limited Performance Tests have been broken up. In the process, several tests have disappeared. For example, in the PVP, MFI-09 and MFI-12 are part of every Limited Performance and Comprehensive Performance test, and are therefore done at every hot and cold level. In the QMR packet, these are both done only once. Also, Table 11-1 does not distinguish between CPT-1 and CPT-2, which raises questions about the number of levels used in radiometric calibration. In several other areas, SBRS is apparently changing the test program from what was approved by GSFC in the PVP. We understand the PVP to be the governing document, requiring government consent for such changes, with Science/Calibration input to that consent.

We recognize that we are undergoing continual modifications to the test program and cutting out many tests. However, we are unable to evaluate the impact of these changes based on the limited information in Table 11-1. In some places, it appears that we may have cut extremely valuable and even necessary tests. With the disconnect of the LPT and CPT definitions and the PVP timeline between QMR Table 11-1 and the PVP, we have no way of evaluating whether SBRS's current test program meets their Performance Verification requirements.

We therefore request that we receive updated information on SBRS's currently planned test program, how this program demonstrates Performance Verification, and what the current definitions of "limited" and "comprehensive" cover. In essence, we are requesting that SBRS either resolve the disconnect, clearly showing what changes to the PVP they are making, or provide us the information to make that comparison. One suggestion is that the PVP descriptions of LPTs and CPTs be dropped in favor of a revised, more detailed version of Table 11-1. Only then will we be able to evaluate the adequacy of the SBRS test plan.

---

d) Draft of MODIS sample orbits for S/C I&T

Author: eknight@highwire.gsfc.nasa.gov (Ed Knight) at Internet
Date: 2/11/96 2:08 PM
Priority: Normal
Subject: Sample Orbits for S/C I&T--Draft

---------- Message Contents ----------

February 11, 1996
To: MODSOT members and MCST folks
From: Ed Knight

Subject: MODIS Sample Orbits

During Spacecraft Integration Tests, Lockheed-Martin plans to run several (eight plus) sample orbits. These will be part of both the interference test and the Comprehensive Performance Tests. These sample orbits are to be designed jointly between us and SBRS. In an Accommodations teleconference on January 23, we agreed to provide our vision of sample orbits to SBRS by February 15. What follows is my cut at this problem. Please provide any comments to me by Thursday morning. I'll pull together a final draft to send to SBRS then.

Sample Orbits

All orbits begin at the equatorial crossing on the dark side of the orbit. All times are in minutes:seconds and should be taken as first approximations. They should also be modified to establish consistency with Instrument level tests at SBRS. Items in brackets are orbital events that would be set by the Lockheed-Martin Team.

1. Simple Orbit

This is designed to be the basic MODIS operational orbit, representing the normal operating situation. Note that I'm assuming a 40/60 day night mode here because the change to 50/50 has still not been implemented anywhere.

Steps: A. 00:00 Begin Orbit in Night Science Mode
B. 16:00 [terminator crossing]
C. 30:00 Transition to Day Science Mode
D. 70:00 Transition to Night Science Mode
E. 83:00 [terminator crossing]
F. 99:00 End Orbit

2. Simple Solar Calibration Orbit

This is designed to be a 'typical' calibration orbit for the solar reflective bands. I've calculated the SD times based on PL3095-N03286 (#1590--November 1993). I would appreciate someone pointing me to a reference with more precise geometry.

Steps: A. 00:00 Begin Orbit in Night Science Mode
B. 05:00 Begin SRCA 1W Radiometric Calibration Mode
C. 10:00 Begin Solar Calibration [terminator -6 min]
Operate SDSM
Open SD door if functional and clean environment
D. 13:30 End Solar Calibration [terminator -2.5 min]
E. 16:00 [terminator crossing]
F. 30:00 Transition to Day Science Mode

G. 70:00 Transition to Night Science Mode
H. 83:00 [terminator crossing]
I. 95:00 End SRCA 1W Radiometric Calibration Mode
J. 99:00 End Orbit

3. Simple Thermal Calibration Orbit

This is designed to check the OBC BB heater and calibration in the heated mode. I've also included the Ecal Tests in here, since linearity is more of an issue for the thermal bands. Note that this ends with the OBC hot! Normal heating/cooling is supposed to take several orbits.

Steps: A. 00:00 Begin Orbit in Night Science Mode
B. 02:00 Begin heating OBC BB.
C. 16:00 [terminator crossing]
D. 30:00 Transition to Day Science Mode
E. 40:00 Begin PV Band Ecal
F. 42:00 End PV Band Ecal
G. 50:00 Begin PC Band Ecal
H. 52:00 End PC Band Ecal
I. 70:00 Transition to Night Science Mode
J. 83:00 [terminator crossing]
K. 98:30 Turn off OBC BB heater (if no heater on next orbit)
L. 99:00 End Orbit

4. Spectral Characterization Orbit

Nainzeng Che and others have spent substantial time looking at how the radiometric and spectral SRCA modes can be used to check each other. This orbit runs such a sequence, and gets us spectral data for trending. Note that this uses the 10W bulbs extensively and so should be run infrequently.

Steps: A. 00:00 Begin Orbit in Night Science Mode
B. 01:00 Begin SRCA Full Spectral Mode
C. 16:00 [terminator crossing]
D. 30:00 Transition to Day Science Mode
E. 70:00 Transition to Night Science Mode
F. 71:00 End SRCA Full Spectral Mode
G. 72:00 Begin SRCA Full Radiometric Mode
H. 83:00 [terminator crossing]
I. 90:00 End SRCA Full Radiometric Mode
J. 99:00 End Orbit

5. Spatial Characterization Orbit

This orbit uses the SRCA Spatial Calibration Mode to gather corregistration data for trending.

Steps: A. 00:00 Begin Orbit in Night Science Mode
B. 16:00 [terminator crossing]
C. 30:00 Transition to Day Science Mode
D. 32:00 Begin SRCA Full Spatial Mode
E. 69:00 End SRCA Full Spatial Mode
F. 70:00 Transition to Night Science Mode
G. 83:00 [terminator crossing]
H. 99:00 End Orbit

6. High Noise Orbit

This orbit runs everything--it's designed to create the maximum disturbances possible for the other instruments. There should be two variations for the SRCA spectral mode--one where we do the full mode, and one where we only use 1W bulbs (preserve lifetime and use during subsequent runs when we're troubleshooting).

Note that Day Science Mode starts and ends at different times than normal.

Steps: A. 00:00 Begin Orbit in Night Science Mode
B. 01:00 Begin SRCA Full Spectral Mode
C. 02:00 Begin heating OBC BB
D. 05:00 Transition to Day Science Mode
E. 10:00 Begin Solar Calibration [terminator -6 min]
Operate SDSM
F. 13:30 End Solar Calibration [terminator -2.5 min]
G. 16:00 [terminator crossing]
H. 20:00 Begin PV Band Ecal
I. 22:00 End PV Band Ecal
J. 30:00 Begin PC Band Ecal
K. 32:00 End PC Band Ecal
L. 41:00 Transition to Night Science Mode
M. 71:00 End SRCA Full Spectral Mode.
N. 83:00 [terminator crossing]
O. 98:30 Turn off OBC BB heater (if no heater on next orbit)
P. 99:00 End Orbit

7. High Sensitivity Orbit

This orbit is supposed to put MODIS in the quietest mode possible in order to detect interferences from other instruments that the sneak past the glitch monitor. It requires

we perform analysis multiple ways--we need to look at the SRCA data from a radiometric standpoint and from a spatial registration standpoint.

Steps: A. 00:00 Begin Orbit in Night Science Mode
B. 01:00 Begin SRCA 1W Scan Direction Spatial Mode
(this is similar to 1W radiometric mode except
thermal source is also on).
C. 10:00 Begin Solar Calibration [terminator -6 min]
Operate SDSM
Open SD door if functional and clean environment
D. 13:30 End Solar Calibration [terminator -2.5 min]
E. 16:00 [terminator crossing]
F. 30:00 Transition to Day Science Mode
G. 70:00 Transition to Night Science Mode
H. 83:00 [terminator crossing]
I. 95:00 End SRCA 1W Radiometric Calibration Mode
J. 99:00 End Orbit

8. Real Time Contact Orbit

This orbit is included more for the mission simulations near the end of Spacecraft testing. We will want an orbit where we check out the ground-instrument real time commanding. I've proposed a memory load and memory dump as a good test of the protocol and contact success (analysis is easy--did the table load successfully and then did it dump successfully? A quick bit comparison answers the question).

I recommend we load and dump the sector start time table. SRCA/BB data during the scans where the alternate table is in place will confirm the success of the load.

Steps: A. 00:00 Begin Orbit in Night Science Mode
B. 01:00 Begin SRCA 1W Radiometric Mode
C. 16:00 [terminator crossing]
D. xx:00 [First real-time contact]
Load Memory Table
D. 70:00 Transition to Night Science Mode
E. xx:00 [Second real-time contact]
Dump Memory Table
Load original Memory Table
F. 83:00 [terminator crossing]
G. 98:00 End SRCA 1W Radiometric Mode
H. 99:00 End Orbit

9. Mode Change Orbit

This orbit is included for the mission simulations near the end of Spacecraft testing. We want a test of our 'go to safe mode' command and recovery ability. Note that this could be run as an 'interrupt' on any of the above orbits.

Steps: A. 00:00 Begin Orbit in Night Science Mode
B. 16:00 [terminator crossing]
C. xx:00 [First real-time contact]
D. xx:00 [Command from S/C or ground to Safe]
E. 70:00 Transition to Night Science Mode
F. xx:00 [Second Real-time contact]
initiate recovery procedures
G. 83:00 [terminator crossing]
H. 99:00 End Orbit

8.0 Tom Pagano (STR60 Alternative)
Author: "Pagano, Thomas S" <tpagano@msmail3.hac.com> at Internet
Date: 2/9/96 2:03 AM
Priority: Normal
Subject: FW: STR060 Spectral
---------- Message Contents ----------

From: Pagano, Thomas S on Thu, Feb. 8, 1996 11:00 PM
Subject: STR060 Spectral
To: Bates, Duane M; Osgood, Roderick L; Pavlov, Milutin M; Tessmer, Arnold L; Therrien, Neil J; Trautwein, Louis E; Young, James B

Jim,

I talked today with Mike Roberto. He suggested we postpone the STR until after the test. He believes that if we can demonstrate that the model based on component data is valid for the bands not affected by atmospheric absorption, then we can use the modeled data for compliance for those bands that are affected by atmospheric absorption. If the modeled data is different than the measured, then we would have to run the STR after the spectral tests to get the data needed to correct the atmosphere.

As we discussed today, we still would need to run the spectral measurement for the atmosphere before we run the MODIS spectral response measurement, and just keep the data in case we need it.

I would like to proceed under the assumption that we postpone the STR, collect the atmospheric data pre-test (I'm assuming this isn't a major ordeal), and perform the STR after test only if needed.

How does this sound to you?

Tom

Author: "Pagano, Thomas S" <tpagano@msmail3.hac.com> at Internet
Date: 2/8/96 10:18 PM
Subject: Bright/Dark Target Test

---------- Message Contents ----------

Charlene,

Can you please draft a letter for review to GSFC requesting the following:

SBRS would like to request a change to the Performance Verification Specification for the Bright Target and Dark Target Within Field Stray Light requirements verification. It is requested that SBRS verify compliance to these requirements by analysis. Rationale is that the Near Field Response Test will acquire data that can be used to verify compliance for this test. Also it is extremely difficult to configure a test to properly simulate the environment in which the requirement applies; i.e. a 21 x 21 dark target with a full #177#110#161# cloud level illumination.

We then need program office concurrence before sending out to GSFC.

Thanks

Tom

MR
2/12/96